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TRAINING OF GEOLOGISTS AND MINING ENGINEERS AND SUPPORT PERSONNEL IN NEW ZEALAND

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1. New Zealand offers four universities with fully staffed, well equipped and active Geology Departments where academic training of geologists to Ph.D. level is available at accepted international standards.

2. There is a tendency for these departments to specialise in some independent branch of the subject, although this does not result in any marked transference of students from one University to another when seeking higher degrees. Otago University has always been famed as a petrological and mineralogical school, and this tradition with structural petrological thinking has been maintained. Canterbury has traditionally been a school of paleontological studies and has recently extended its activities into the field of sedimentation, with the aid and support of the New Zealand Geological Survey in establishing a joint laboratory. Wellington University lays considerable stress upon field mapping and structural geology, with recent attention being devoted to microfaunas. The latest addition to this department at Wellington has been a Senior Lecturer in Soil Science. Auckland University has maintained the broad aspect of structural geology based on petrology and field mapping. These courses are interleaved with considerable field work and field geology. Geological mapping is taught generally in conjunction with field excursions, but a more formal course is available at Wellington.

3. No formal training is available in geophysics, although the Physics Departments do provide some aspects of geophysics, generally upper atmosphere. Extra curricula lectures in earth geophysics are given by members of the Geophysics Division of the Department of Scientific and Industrial Research.

4. Under-graduates can advance to a degree of B.Sc. with Honours in Geology, and then proceed to M.Sc. with distinction, or directly to Ph.D.

5. As a consequence of the high level of University geology teaching and post-graduate research, employers of geologists in New Zealand are able to draw on a pool of recruits who are academically well equipped and thoroughly acquainted with their discipline. Those who are particularly interested in making geology a career and who are

doing post-graduate work have usually sought vacation employment with the New Zealand Geological Survey in order to gain some experience of a working geological institution. The New Zealand Geological Survey is able to offer vacation employment to students in the field and in petrology and paleontology laboratories. This allows the student to gain working experience; it teaches him professional mapping techniques, techniques of fossil preparation, and of petrology and mineralogy preparations and determinations. It gives him an insight into indexing methods and data recording, particularly of fossils, rocks, and minerals. In the field the student gains an insight into methods of field mapping, the use of air photographs, recording of data, and keeping of record sheets. At the same time the New Zealand Geological Survey is able to evaluate the student as a potential recruit. As a result, this is a most effective means of recruiting. The obverse holds in that the student can decide for himself whether or not the type of professional life the Geological Survey offers is to his liking. The cordial relationships between University geology departments and the New Zealand Geological Survey operate to the good of geology as a whole and must owe much to the lucky accident of the relatively small geographic size of New Zealand having within its geology a continental complexity.

6. New Zealand can supply a training to geologists which can be a combination of academic work of a high standard with field and practical work in the New Zealand Geological Survey. This training would equip any newly-formed geological survey with officers having a background of practical work and a scientific knowledge of a high order.

7. On the mining side, a degree B.E. or M.E. is gained from the University of Otago School of Mines; an Associateship (A.O.S.M.) is also provided. The mining course covers a wide curriculum of mechanical engineering, mining practice, ore dressing, and economic geology and other basic science subjects. This course is associated with mandatory practical work in mining. Unfortunately there is very little mining activity in New Zealand other than coal mining, and the tendency is to acquire practical work in the Australian metal mines. Nevertheless, there is a very high standard of training given and the resulting graduates possess a reputation throughout the world.

8. University graduates from newly-emergent countries who are unable to obtain proper field experience or experience in laboratory techniques in geology can obtain this training in New Zealand. The New Zealand Geological Survey can provide the opportunity for young geologists of newly-formed geological surveys to receive field training, training in field mapping, the use of air photographs, and other field techniques, together with laboratory training in various techniques of petrology, mineralogy and paleontology. New Zealand has some advantages in this field; it can offer very interesting and complex geology, and it has a small geographic compass. In addition it offers scope for geological surveys in emergent countries as they are likely to be of comparable size to the New Zealand establishment. If young students were to obtain field and institutional training in some of the geological surveys of the larger industrial countries, they possibly would be impressed by the wealth of instrumentation of such surveys. This is a dangerous course, particularly when many countries newly

attached to the United Nations have yet to complete their basic geological mapping. For this purpose no great instrumentation is needed but the stress is on the field geologist who goes out in the field and looks at rocks in the field.

9. For the purposes of this paper support personnel are assumed to be non-academically-qualified people whose interest and enthusiasm is in the field of geology. A number of these people are employed by the New Zealand Geological Survey and many of these technicians have shown great ability and adaptation, have developed special techniques and have become authorities in a particular subject. Some have even gone so far as taking a particularly specialised aspect of the work and studying it at professional level. A few have finally transferred to the professional division without having taken any academic course. Support personnel, however, generally remain as technicians but as time goes on they usually develop into a field of their own (water supply geology, fossil seeds, Recent foraminifera - to name but a few), where they work to a professional standard.

10. In New Zealand this development among technicians is encouraged and in several districts technicians are able to take over water supply work, mineral sampling, coal sampling, and a number of other tasks thus allowing the professional officers to devote more time to research aspects.

11. The New Zealand Geological Survey can provide support personnel training in the major sections of a modern geological survey.

(a) Field Geology. While assisting field geologists there is ample opportunity to gain experience in methods of collecting, packing, marking and preserving specimens. Elementary field mapping over a variety of scales, and the use of air photographs as a mapping tool are also subjects in which experience is available. This is coupled with petrological and paleontological collecting and the sampling of industrial minerals and rocks.

(b) Petrology and Mineralogy. Training is given in methods of sampling, crushing and preparation techniques for subsequent mineralogical examination. Experience is gained in the use of a wide variety of techniques in cutting, grinding and mounting thin rock sections and in polishing and mounting ore specimens for examination under reflected light. Elementary mineral separation can be carried out using mechanical, magnetic electrostatic and heavy liquid methods, together with the operation and use of X-rays with powder samples. Experience in the use of punch cards for recording petrological data can be obtained. Elemental mineral determinations can be made using optical methods.

(c) Paleontology. In macropaleontology training in the use of the techniques of cleaning and recovering specimens, in the methods of preparing plaster, rubber latex or vinyl casts and moulds is available. In micropaleontology, study and practice in methods of breaking down sediments mechanically, chemically, and with sonic vibration is available. There is also opportunity to undertake preliminary selection and methods

of mounting. In the study of fossil botany training can be had in the techniques of breaking down of carbonaceous sediments, and the separation and final mounting of fossil spores and pollens.

(d) Cartography. Training in methods of compiling field sheets from a variety of base maps and air photographs is given. Opportunity is available to study layout and preparation of illustrative work leading to higher grade cartographic colour work.

(e) Library. There is opportunity available to train in the work of a specialized library in cataloguing and circulation together with literature search to assist professional officers. To those wishing to advance in this section, attendance at the National Library School can be facilitated.

12. The whole question could be summed up by saying that training in New Zealand arises from a first class academic course obtainable at any one of four Universities. This course has a long tradition of very able and eminent geology professors, and today is seeing an expansion in teaching staff that enables a very broad curriculum to be undertaken, at the same time permitting staff to undertake research to the benefit of the faculty as a whole. The cordial relationships between New Zealand Geological Survey and the University geology departments enable students to undertake vacation work in the field or in the laboratory, thus gaining valuable training in the applied aspects of their work and at the same time learning what it is like to work in a national geological organisation. The end product of this method is a geologist academically qualified to a high degree and as experienced as he can be in the various methods of field and laboratory geology.

13. Where this training cannot be obtained locally the New Zealand Geological Survey is quite prepared to provide it for geologists from the geological surveys of the smaller, newly-emergent countries.

14. Support personnel can also be training with the New Zealand Geological Survey in all laboratory preparation techniques connected with paleontology, micropaleontology, palynology and petrology. These are developed to a very high order in the New Zealand Geological Survey and some technicians have already published papers on new techniques they have developed. Field technicians also can receive training that will include sampling, surveying, use of air photographs, and the recording of field data.

15. We in New Zealand can offer this training at a very high level and in a country where the geology is sufficiently complex to give a student a wide variety of experience. At the same time he would work with a geological survey of the size comparable to that which some of the newer countries will need to accomplish their basic geological mapping which is fundamental to their industrial well-being.

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